

REMARKS

Applicants acknowledge the indication of the allowability of the subject matter of Claims 18 and 22-26, as set forth at paragraph 4 (page 3) of the Office Action. In particular, the latter claims would be allowable if rewritten in independent form. Nevertheless, for the reasons set forth hereinafter, Applicants respectfully submit that Claims 18 and 22-26 are allowable in their present dependent form.

In response to the objection to the Abstract of the Disclosure, Applicants have revised the Abstract, which is set forth on a separate page attached herewith, as required. In addition, Claim 27 has been amended in the manner suggested by Examiner, in response to the objection set forth in paragraph 2 of the Office Action. Accordingly, reconsideration and withdrawal of these grounds of objection are respectfully requested.

Claims 17, 19-21, 27 and 28 have been rejected under 35 U.S.C. §103(a) as unpatentable over Traux (U.S. Patent No. 4,323,946) in view of Eybert-Berard et al (U.S. Patent No. 6,072,684) and further in view of Loncaric (U.S. Patent No. 4,224,655). Nevertheless, as discussed in greater detail hereinafter, Applicants respectfully submit that all claims currently of record in this application, including new Claim 29, distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to a lightning protection apparatus which is suitable for use, for example, in radomes, installed in aircraft. Because of their relatively "sharp" extremity, radomes (and the tops of tall buildings, etc.) are particular prone to be struck by lightning in a storm.

The present invention addresses and resolves this problem by directing a flow of an electrically conductive fluid across the outer surface of the radome, thereby providing a conductive path for the passage of the large electrical currents which result from lightning strikes. In this manner, the electrical energy can be dissipated without damage to the radome. Moreover, unlike previous solutions, which have involved the use of metal conductors that tend to ablate under the extreme temperatures and electrodynamic forces caused by the large currents associated with a lightning strike, the system according to the invention can be used repeatedly without replacement. Moreover, the invention also avoids the necessity of using metallic conductors on the radome, avoiding the serious distortion of radar system radiation patterns, which can degrade the systems performance.

The Traux patent discloses apparatus for reducing stored electrostatic charge levels on dielectric surfaces, including as one example, a radome. Such an electrostatic charge can be generated, for example, by the flight of an aircraft through precipitation, such as snow or rain. (See Abstract; Column 1, lines 24-35; Column 3, lines 24-26.) For the purpose of dissipating electrostatic charges,

one embodiment of the Traux apparatus utilizes a grid of electrical conductors 12 which cover the surface of the dielectric article 13 which is to be protected, and may be electrically connected to a conductive component 9. (See Column 4, lines 46-50.) In another embodiment, illustrated in Figures 15 and 16, the formation of electrostatic charges on, for example, an aircraft windshield, is inhibited by eliminating a static boundary layer of relatively stagnant air which is adjacent the windshield. For this purpose, a flow of fluid, which may be conductive or non-conductive is directed over and parallel to the charged dielectric surface, thereby increasing the mobility of ions formed by the impact of air on the windshield. (See, for example, Column 7, lines 46-68.)

An important aspect of the Traux reference, however, is that it is directed solely to the dissipation of electrostatic charges accumulated in the manner described previously, and has no applicability to the conduction of the large currents which can result from lightning strikes on a radome unit. Thus, for example, at Column 4, lines 60-62, Traux notes that the width and thickness (or diameter) of the conductors (in the first embodiment which utilizes electrical conductors) can be less than a micrometer "and still be adequate to carry the electrical currents involved".

The same is true of the embodiment of Figures 15 and 16 in which the function of the flow of fluid over the surface of the dielectric component is merely to provide increased ion mobility, and not to accommodate the large currents

which result from lightning strikes. Thus, for example, at Column 7, lines 58-60, Traux notes that the fluid may include, among other things "conductive or non-conductive liquids". That is, for the purpose of conducting the small currents involved, the fluid acts merely as a transporter of ions, and need not be an electrical conductor at all.

The Office Action at page 3 refers to the lightning strike protection circuit of Traux. However, it is apparent from the foregoing brief description that the Traux reference does not disclose a lightning strike protection circuit, but rather a circuit for dissipating electrostatic charges resulting from "triboelectric charging". Traux in fact contains no discussion which teaches or suggests any apparatus which would be sufficient for conducting large currents in order to dissipate a lightning strike. In fact, Traux refers to lightning strikes at only two points in the disclosure. The first is at Column 5, line 65, which points out that the use of properly chosen resistive connecting materials 14 and conductors 11 will allow the transmission or passage of radio frequency energy, and provide the advantage of "not attracting or providing attachment locations for lightning [strikes]". Similarly, at Column 8, lines 63-68, Traux notes that the use of such resistive conductors is that they "tend to not support the currents of lightning step leaders". Moreover, in the embodiment of Figures 15 and 16, as noted previously, the sole function attributed to the fluid flow is to provide ion mobility, and for this purpose, even a non-conducting fluid is sufficient. Accordingly, it is

apparent that the apparatus in Traux is not intended to, and is incapable of, dissipating electrical energy from a lightning strike.

The Eybert-Berard et al reference, on the other hand, discloses a method and apparatus for protecting a site against a lightning strike, which utilizes a technique that is fundamentally different from that of the present invention. In particular, this reference uses a laser beam to create an ionized channel to direct a lightning discharge toward a conductor. As noted in the Office Action, Eybert-Berard et al utilizes capacitive antennas to monitor the electric field in the region of the site which is being protected, and the field variation is analyzed in a microprocessor, so that the laser beam can be triggered at an appropriate time.

While the Eybert-Berard et al patent thus discloses a lightning protection arrangement, it contains no discussion which would suggest to a person skilled in the art any modification of the Traux reference (which also differs fundamentally from Eybert-Berard et al) in a manner which would make it suitable for protecting radomes against lightning strikes.

Finally, like Traux, Loncaric is directed to a method and apparatus for dissipating static electric charges. In particular, Loncaric is concerned with reducing the hazards encountered upon opening petroleum producing and transporting equipment, due to a buildup of internal electrostatic charges. In order to dissipate such charges, a flow of non-flammable liquid, such as brine or an anti-static chemical, is passed over the internal surface of the equipment, so

as to increase the rate of discharge of static electricity inside the equipment. Like Traux, this patent is not concerned with lightning strikes, and contains no subject matter which would suggest to a person skilled in the art a modification of Traux (or Eybert-Berard et al) in order to replicate the lightning protection apparatus according to the present invention.

In particular, Claim 17 recites "a lightning protection apparatus for a radome attached to an air frame". Similarly, Claim 27 defines a method for "conducting lightning across a surface of a radome" while Claim 28 defines a method for "conducting lightning across the surface of a non-conducting article". Finally, new Claim 29 recites radome apparatus for an aircraft which includes "first means for providing a conducting path for conducting electricity from a lightning strike" that impinges on the radome to the aircraft body. None of the references cited in the Office Action teaches or suggests such an apparatus or method.

Finally, Applicants note that the recitation of "a lightning protection apparatus" in the preamble of Claims 17, 27 and 28 constitutes a structural limitation which is part of and defines the claimed invention. It is therefore entitled to be given weight. As in *Kropa v. Robie*, it is only by the phrase in the preamble ("a lightning protection apparatus for a radome") that it can be known that the subject matter defined by the claims is in fact a lightning protection device. 187 F.2d 150, 88 U.S.P.Q. 478 (C.C.P.A. 1951). Moreover, each of Claims

17, 27 and 28 recites in the body that the fluid flow provides a channel "having a current conducting capacity sufficient for conducting any current induced by a lightning strike". Accordingly, this feature is part of the claimed invention, and is entitled to be given weight. It is neither taught nor suggested by any of the cited references.

In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested. If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #2101/50765).

Respectfully submitted,



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